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(54) A system and method for controlling the delivery of pumpable chemicals

(57) The present invention provides a system for controlling the delivery of pumpable chemicals, comprising:

- one or more washing devices (51,52,53);
- one or more dispensing devices (54) for dispensing chemicals to the washing devices; and
- one or more control units connected to the dispensing devices (54) or to valves (91,92,93) for connection/disconnection of fluid lines between the dispensing devices and the washing device, said control units including an intelligence cell (64,64',64",74) and a transceiver unit (65,65',65",75) connected to said intelligence cell.

The control system according to the present invention is very versatile, and can be used by almost every conceivable setup of a number of washing devices, starting from a separate dish washing device for a caterer, to an industrial laundry. The present invention make use of distributed intelligence, which form a plural network. In this context it is to be noted that a washing device may comprise dish washers, wash extractors, tunnel washers, bottle, crate and/or a keg washing devices or other. The devices can be single tank machines or multitank machines.

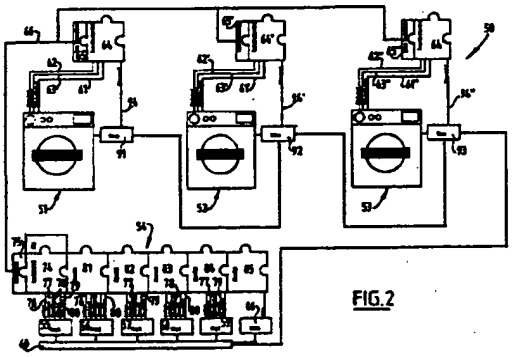

FIG.2

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Description

Delivery or dosing of chemicals or detergents for washing purposes, such as in professional laundry washing machines, professional dishwashing for caterers, hospitals and the like, as well as in bottle washing apparatus, plays an important role for the degree of cleanness reached without using too much chemicals. Dispensing of chemicals in a high amount can lead to deterioration of fabric material and problems with respect to dishes, glasses, cups bottles and so on, when food or drinks are consumed therefrom.

Fabric washing machines and dish washing machines are used in a wide variety of environments, starting for instance from a caterer environment which may be somewhat similar to a household environment, to almost industrial environments, such as large laundries or hospitals. In practice for each application and environment, special control systems have to be designed and implemented, either by the manufacturer of the washing device or by the provider of washing chemicals.

After a washing device has been sold by the manufacturer, and the warranty period has lapsed, the user of the device will usually hold the detergents' provider responsible if a washing device does not operate satisfactory, irrespective of the state of the machine. Therefor the provider of such chemicals will usually have to service the machine and/or dispensing units for dispensing the washing chemicals. For each design of a control system, service engineers have to be trained.

For reasons of efficiency washing chemicals are delivered to the user in more and more condensed form, which makes it even more important not to dose too much of such condensed products which may have undesired effects to the persons using the washed objects or to the cleaned fabrics.

US patent 4,763,494 of applicant describes a modular liquid dispensing system wherein separate modules contain pump and electronic components. According to this prior art system, however, the electric components have to be specially designed for each application.

US patent 5,014,211 discloses a liquid chemical delivery system for a number of industrial cloth washers, said system comprising a centralized pump controller unit. For each application of this prior art system, the pump controller unit will have to be programmed, so that for each application programming labour has to be invested.

The present invention provides a system for controlling the delivery of pumpable chemicals, comprising:

- one or more washing devices;
- one or more dispensing devices for dispensing chemicals to the washing devices; and
- one or more control units connected to the dispensing devices or to valves for connection/disconnection of fluid lines between the dispensing devices and the washing device, said control units including an intelligence cell and a transceiver unit connected to said intelligence cell.

The control system according to the present invention is very versatile, and can be used by almost every conceivable setup of a number of washing devices, starting from a separate dish washing device for a caterer, to an industrial laundry. The present invention make use of distributed intelligence, which form a plural network. In this context it is to be noted that a washing device may comprise dish washers, wash extractors, tunnel washers, bottle, crate and/or a keg washing devices or other. The devices can be single tank machines or multitank machines.

The chemicals to be dosed can be delivered to the costumer in any desired form, viz. in solid form, in powder form, or in fluid or gel form. In a preferred embodiment, the dispensing devices comprise pumps for pumping fluid detergents to the washing devices.

Servicing of the washing machines will be facilitated using the system according to the present invention, as the hardware and software to be standardized.

Preferably the intelligence cells and transceiver unit are part of a so called Local Operational Network (LON) as introduced by Echelon Corporation of Palo Alto, California, for which network integrated circuits are provided by Toshiba and Motorola. Further details of LON are disclosed in international patent application WO 92/17952, international patent application WO 92/21180, US patent 4,918,690 as well as other documents provided by the above company. In this LON an intelligence cell comprises a timing and control section, an input/output section, a communication port, internal memory and a three processor central processing unit, said three processors sharing a common memory, arithmetic unit and control circuitry.

Preferably the system according to the present invention comprises standardized plugs and sockets, which makes servicing even simpler, so that it can be executed by a wide variety of individuals having a limited technical background or training.

Preferably a flow meter is provided in the fluid line between and pump washing device, whereby the control of a number of pumps and the dispensed quantity of chemicals can be executed very accurately. More and more users of washing devices prefer to make payments to the provider of detergents per unit of cleaned product. In such accounting systems accurate information regarding the behavior of the costumer has to be available to the detergent provider.

Preferably an intelligence cell comprises a master unit and one or more slave units connected thereto, preferably under the I^2C protocol. Details of the I^2C protocol are to be found in manuals of the Dutch Philips Electronics N.V. In the LON system, using master and slave units, all master units and slave units will obtain automatically an address when connected in the system. Programming labor is therefor further reduced. In

the system according to the present invention no redundant hardware and/or software need to be installed, while further functions can easily be added to the system.

The system according to the present invention is preferably provided with a datalog unit and a modem for storing information parameters from the operation of the control system, and for trouble shooting on a remote basis. By storing process information from the washing devices, the communication between the user, manufacturer of the washing device and the detergent provider will be improved, and dispensing of chemicals can be optimized. The amount of water use by washing machines can accurately be established, which provides further information for the manufacturer of the system.

The intelligence cells communicate with one another on the network by exchanging packets of data while the connections in the network can be established by a variety of media, such as power line, twisted pair, radio frequency, infra-red, ultrasonic, optical, coaxial etc.

Further characterizing features, advantages and details of the present invention will become clear in the following description with reference to the annexed drawings, which show:

fig. 1 a diagram of a first embodiment of the system according to the present invention;
fig. 2 a diagram of a second embodiment of the system of the present invention;
fig. 3 a diagram of a third embodiment of the system of the present invention;
fig. 4 a diagram of a fourth embodiment of the system of the present invention;
fig. 5 a diagram of a fifth embodiment of the system of the present invention; and
fig. 6 a diagram of a number of modules to be used with the system according to the present invention.

A washing device 1 (fig. 1) provides e.g. two condition signals, viz. a wash signal and a bleach signal over lines 2 and 3, resp. to a first LON master unit 4 of the 3150 type which is connected to a first pump 5 for dosing or delivering washing chemicals to the washing device 1. A number of signal lines are provided between the pump 5 and the master unit 4. A first signal line 6 provide a signal to the master unit 4 when leakage occurs in the hose or peristaltic pump 5 because of shortcircuiting of contacts in the housing of the pump. A second line 7 provides a signal to master unit 4 when the level of the chemicals in the pumps, is below a predetermined level. Signal line 8 provides an alarm signal to the master unit 4, whereafter an audible or visible alarm will be indicated by the master unit 4. Signal line 9 provides the possibility of signalling a visible alarm on the pump housing of the pump. Signal line 10 delivers the on/off pump signal to the pump 5 for driving/not-driving of the motor of pump 5. In this embodiment there is a flow meter 12 in the fluid line 11 to the washing device 1, which an output signal is sent over line 13 to master unit 4. The master unit 4 is connected to a power supply 14 and a transceiver unit 15 according to the LON protocol which in this embodiment is connected by a twisted pair 16 to a second LON transceiver unit 17, so that the first master unit 4 is in communication with a second master unit 18 also provided with a power supply 19.

The second master unit 18 is connected to a second pump 25 through lines 26, 27, 28, 29, 30 and to a second flow meter 42 through line 43 resp., which have the same function as lines 6 - 10 and 13 resp. for delivering bleaching chemicals by pump 25 through line 41 to washing device 1.

In a not shown way pumps 5 and 25 are connected to a storage tank for the respective chemicals. Also not shown in fig. 2 is the possibility for connecting a modem or personal computer for controlling and/or remote diagnosing purposes. Each master unit can be connected to a simple keyboard, for instance with a LCD-display and a small number of keys or to more comprehensive keyboards such as for personal computers. Such keyboards and displays can easily be connected e.g. for service purposes to any of the master units in the system, where all information regarding the complete system is available.

In a system 50 (fig. 2) comprising three laundry washing devices 51, 52 and 53, e.g. for a professional laundry company, a remote central dosing system 54 is provided e.g. in a separate room for keeping the chemicals away from the people using the laundry devices 51, 52 and 53, where in a master unit 64 is associated with each laundry device and is connected to each laundry device through three conditioning signals over lines 61, 62 and 63 for obtaining a water meter signal, a bleach signal and a wash signal resp. therefrom. Each master unit 64, 64', 64" is provided with a transceiver 65, 65', 65", which are each connected via a field bus 66 to each other and to a transceiver 75 which is connected to a master unit 74 of the central dozing system. The central dosing system 54 comprises five pumps 55, 56 57, 58 and 59 resp. which are connected to a central manifold 60 via fluid lines. Pump 55 is connected to master unit 74 through electrical signal lines 76 - 80 which correspond with signal lines 4 - 10 of fig. 1. Pumps 56 - 59 are each connected to corresponding signal lines 76 - 80 to slave units 81, 82, 83 and 84 which are connected under the I^2C protocol to master unit 74. A further slave unit 85, also connected through the I^2C protocol to master unit 74 controls a water flush valve 96 for flushing the manifold 60 after each dosing of chemicals by one of the pumps 55 - 59 to manifold 60. The manifold 60 is connected to a fluid flow line 90 to valve 91, 92 and 93 which are associated with washing devices 51, 52 and 53 resp.. The valve 91 - 93 are each connected by a control line 94, 94', 94" to master unit 64, 64' and 64".

In this shown embodiment the master unit 74 is provided with a standardized power supply PSU. If neces-

sary for driving the various pump motors, additional power supplies can easily be plugged to one or more off the slave units 81-85. This is of course also possible in other embodiments.

In the system according to fig. 2 it is possible to pump five different chemicals to each washing device dependent on the required washing/bleaching program for the laundry devices. The system 50 makes use of the same modular electronic components of the LON type as the system according to system 1. Each washing device in both systems is provided with an intelligence cell which are connected to each other by means of a transceiver and a field bus. The communication protocols are as much as possible standardized, whereby servicing and remote diagnosis are facilitated to a high degree. An individual having a limited technical background and/or training should be able to replace a standardized module, containing one or more integrated circuit boards, when visiting the premises of a costumer.

In the more comprehensive system of fig. 3 each master unit 64, 64', 64" is provided with a digital input unit 95, 95' and 95" which are connected to line 96 - 110 resp., for functions such as sensing the position of the door switch of the washing device, sensing a start/stop function for the washing device, sensing selection signals for five classes of laundry, sensing of the position of a valve for admitting steam into a laundry device, for sensing the presence of cold and hot water of a number of different temperatures in the washing device through a number of signals, sensing the position of the drain valve, sensing the presence of soft water in a washing device and sensing if cooling down takes place. Operation of the pumps 75 - 79 is controlled through master unit 74 and slave units 81 - 85 together with the intelligence cells 64, 64', and 64".

A system for control of a dish washing device 120 (fig. 4) comprises a LON master unit 121 provided with a power supply 122, and for controlling a pump 123 through line 130 for on/off control of the pump motor. In the same way in the system according to fig. 1-3 pump 123 is connected to master unit 121 through lines 126 - 130 for leakage monitoring, a conditioning signal for the low level of the chemicals in the pump 123 and alarm functions. The master unit 121 obtains three digital signals from the dish washer 120 through lines 119, 124 and 125 for the water meter signal, rinse signal and wash signal resp.

A more comprehensive dish washing system comprises a dish washer 140 (fig. 5) wherein the dishes, glasses, cups to be cleaned are fed through different sections 141, 142 for washing in a continuous operation, as is mandatory e.g. in hospitals, and hotels, because of the amount of dishes etc. to be cleaned. The system according to fig. 5 comprises a LON master unit 151 provided with a transceiver 152 for connection and communication with a transceiver 153 of a second master unit 154 which is also provided with a power supply 155. The master unit 151 is connected through lines 161 - 167 to the washing device 140 for obtaining digital wash signals, rinse signals, fill signal, machine-on signals, fill water meter signals, rinse water meter signals and alarm signals resp. To the master unit 151 also an analog unit 168 is connected for obtaining analog signals of the washing process in the device 140. The analog unit 168 is connected through lines 169, 170, 171 and 172 for measuring the conductivity of the washing fluid, for measuring the pre-wash temperature, for measuring the main wash temperature and for measuring the rinse temperature resp. Also on basis of these conditions signals of the washing process pumps 180, 181, 182 are controlled by LON master unit 154, wherein pumps 181 and 182 are controlled through slave unit 156 and 157 resp., which use the I^2C protocol for communication with the master unit 154. Each pump is connected to the respective control unit via lines 186 - 190 which are equivalent to lines 6 - 10 of fig. 1 and corresponding lines of fig. 1 - 5.

Fig. 6 shows a number of modules or standardized components, which can easily be connected to intelligence cells, which connection, as in the previous figures, is schematically indicated by giving the module to form of a piece of a jigsaw puzzle. Apart from a slave unit 201, a digital input unit 202 and an analog unit 203 which have been discussed in connection with the figures 1-5, fig. 6 shows a display unit 204, provided with four keys 205, 206, 207, and 208, and a display 209 preferably a liquid cristal display. A further module 210 is provided with a alfanumeric display 211 of four lines.

Another module (of the I^2C system) is a keyboard 211 showing sixteen keys. Module 212 can be used for indicating the time and date, preferably to be used together with module 213 which is a data log EEPROM for storing information.

As will be clear from the forgoing discussion, all modules can permanently or only for a short period, e.g. by the service engineer, be connected to every intelligence unit in the system, as all information about the system can be shown and/or retrieved by every conceivable intelligence cell thereof.

Especially by using modules 212 and 213 data of the resp. washing process can be obtained and further analyzed after storage. Commands to the system can be executed by using modules 204 and/or 211, while information from the system can be read on site from the displays.

In this respect it is important to note that the present invention is not limited to dosing of detergent by pumps. More concentrated detergent will be dispensed or dosed by means of solution in water, or in any other conceivable way. The present invention is not limited to the above illustrative embodiment. The requested rights are defined by the annexed claims.

Claims

1. A system for controlling the delivery of pumpable chemicals, comprising:

- one or more washing devices;
- one or more dispensing devices for dispensing chemicals to the washing devices; and
- one or more control units connected to the dispensing devices or to valves for connection/disconnection of fluid lines between the dispensing devices and the washing device, said control units including an intelligence cell and a transceiver unit connected to said intelligence cell.

2. A system according to claim 1, wherein the dispensing devices comprise one or more pumps.

3. A system according to claim 1 or 2, wherein the cell comprises a timing and control section, an input/output section, a communication port, internal memory and a three processor central processing unit, said three processors sharing a common memory, arithmetic unit and control circuitry.

4. A system according to claim 1, 2 or 3, wherein two transceiver units are connected by a twisted pair of electrical cables.

5. A system according to claim 1 - 4, wherein the intelligence cells, dispensing devices, transceivers and/or communication lines are provided with standardized plugs and sockets.

6. A system according of any of claims 2 - 5, wherein a standardized number, preferably five, of signal lines are provided between a pump and an intelligence cell, e.g. for detecting leakage in the pump, for providing an on/off signal to the pump and for providing an alarm indication.

7. A system according to any of claims 1 - 6, wherein a flow meter is provided in the fluid line between dispensing device and washing device.

8. A system according to any of claims 1 - 7, wherein an intelligence cell comprises a master unit.

9. A system according to claim 8, wherein an intelligence cell is provided with one or more slave units connected to the master unit for controlling one or more dispensing devices connected to the slave units.

10. A system according to claim 9, wherein communication between the master unit and the slave units takes place under the I^2C protocol.

11. A system according to any of claims 1 - 10, provided with a centralized dispensing system and a number of valves associated with a respective washing device, wherein each valve is controlled by an intelligence cell.

12. A system according to any of claims 1 - 11, wherein each intelligence cell receives one or more condition signals through signal lines from a respective washing device.

13. A system according to any of claims 1 - 12, provided with a keyboard for entering the control instructions and a display for monitoring the operation of the system.

14. A system according to any of claims 1 - 13, provided with a datalog unit for storing data of the operation of the control system.

15. A system according to any of claims 1 - 14, provided with a modem for obtaining service and/or control information on a remote basis.

16. A method for controlling the delivery of pumpable chemicals to one or more washing devices, wherein each washing device is controlled by an intelligence cell.

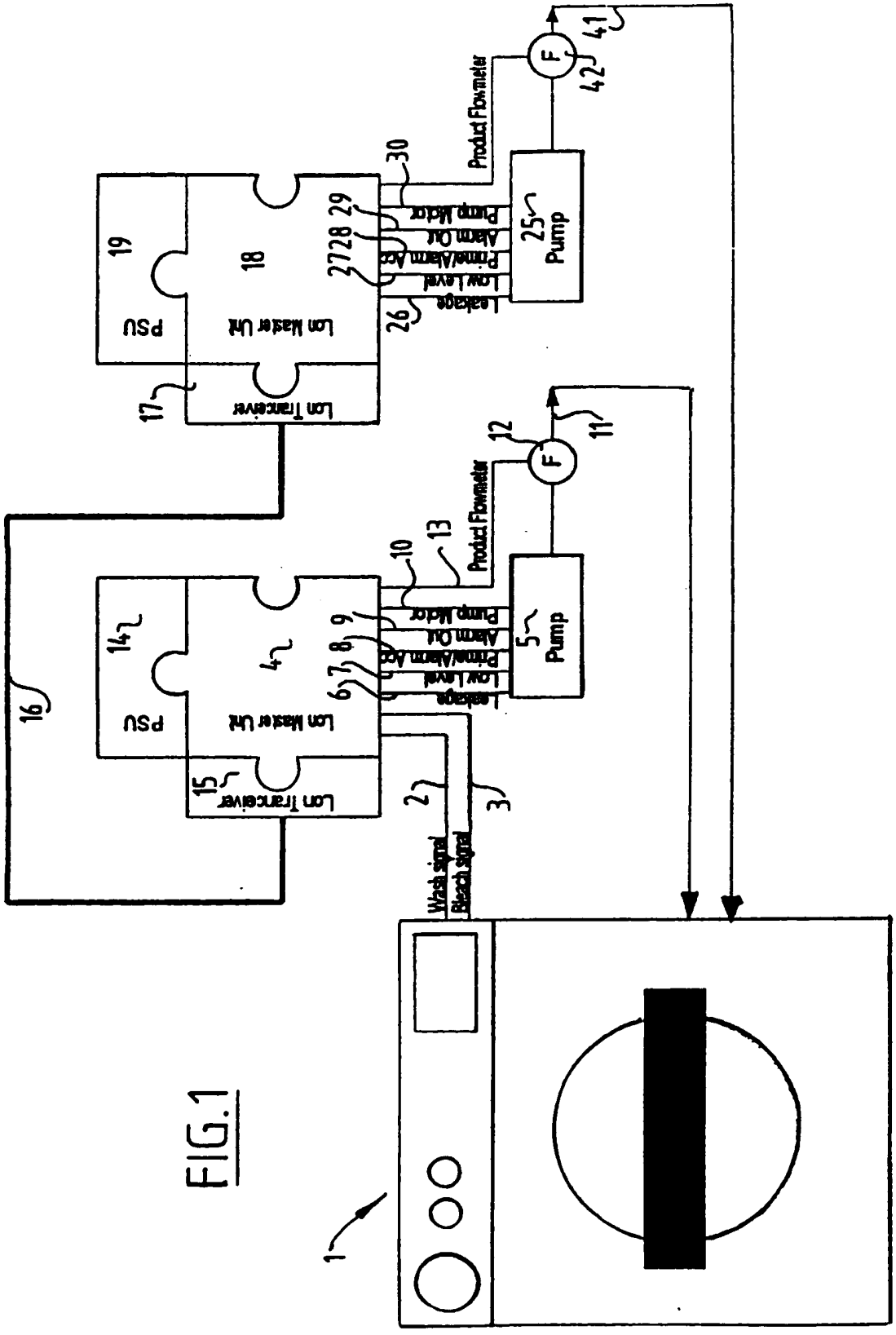
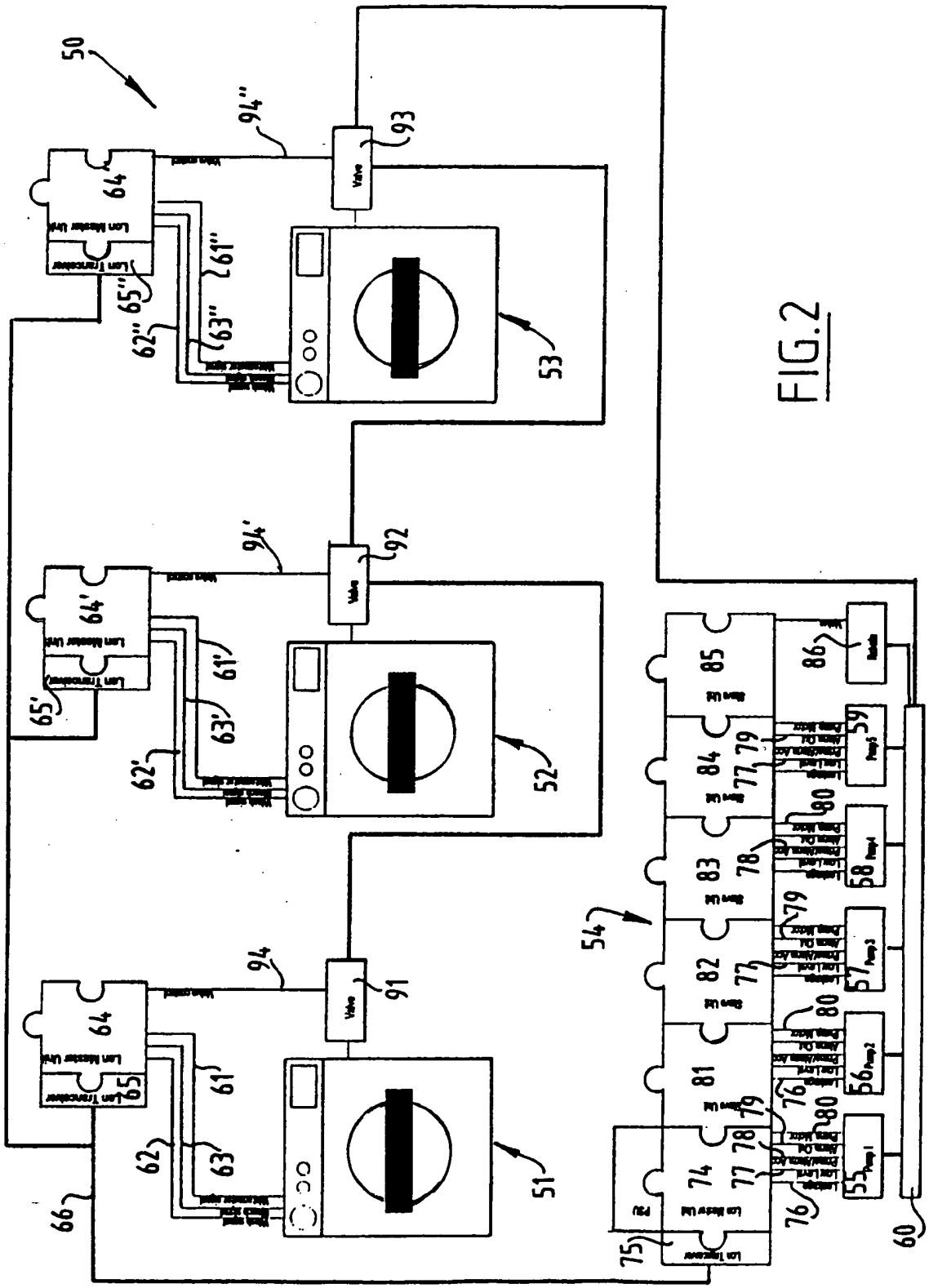

Product Flowmeter
Pump
Wash signal
Bleach signal
PSU
Lon Master Unit
Lon Transceiver
Prime/Alarm Out
Alarm Out
Pump Motor
Low Level
Leakage

FIG.1


50
94''
93
64
61''
65''
62''
63''
53
94'
92
64'
61'
65'
62'
63'
52
94
91
64
61
65
62
63
66
51
54
85
86
84
77
79
80
59
83
78
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76
79
80
56
74
77
78
55
75
76
60

FIG.2

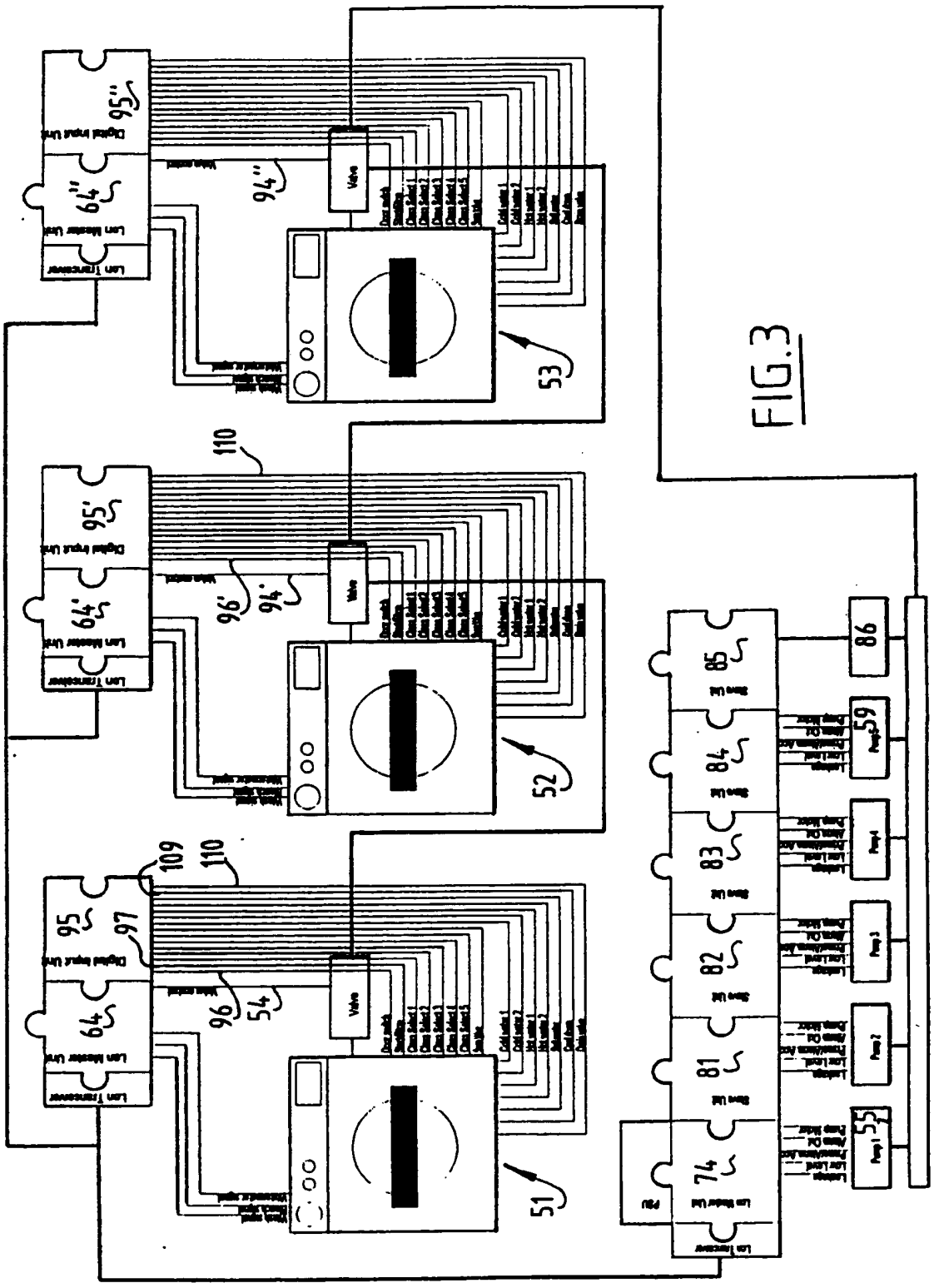
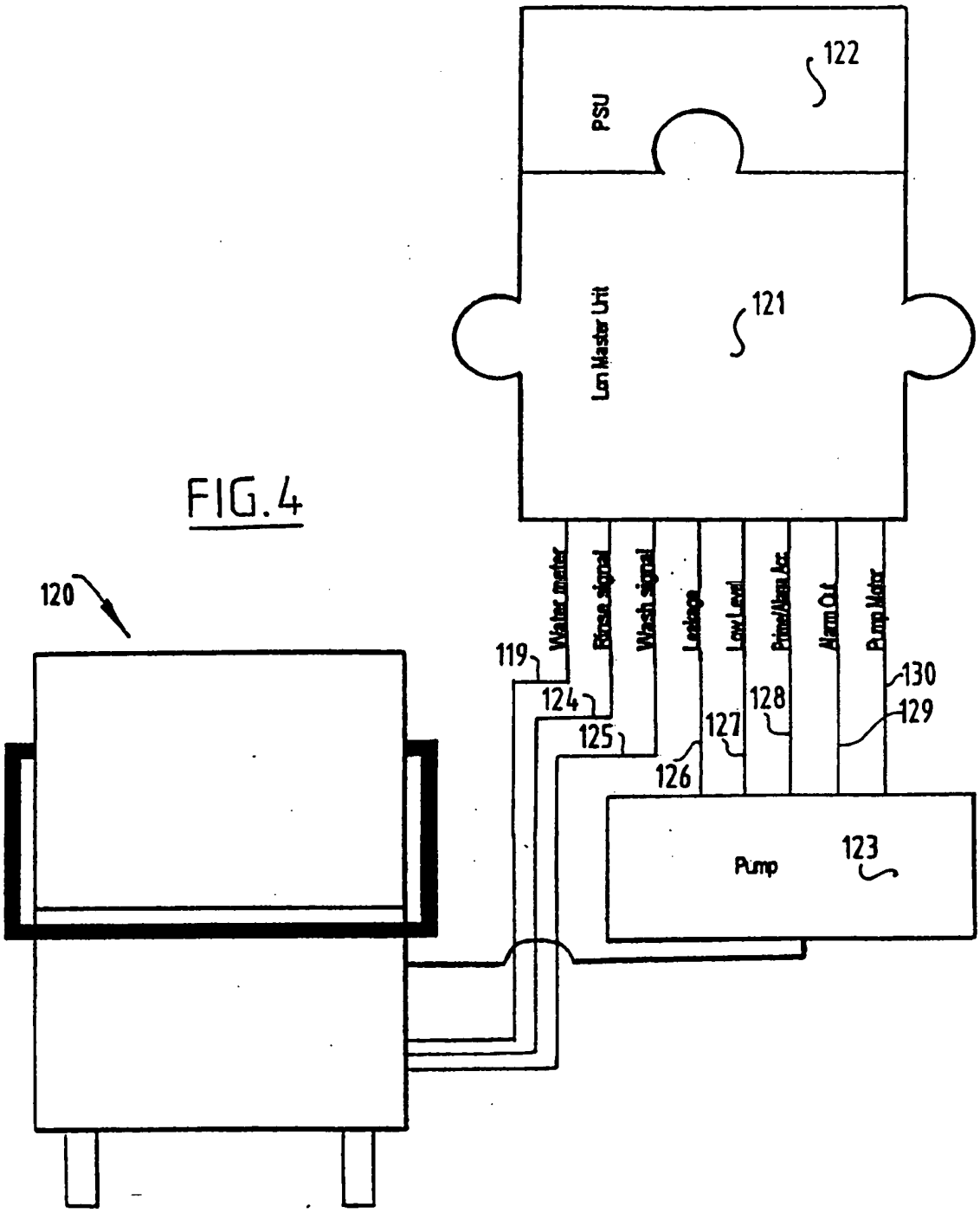


FIG.3

FIG.4


PSU
122
Lon Master Unit
121
120
119
124
125
126
127
128
129
130
Water meter
Rinse signal
Wash signal
Leakage
Low Level
Prime/Alarm Acc
Alarm Out
Pump Motor
Pump
123

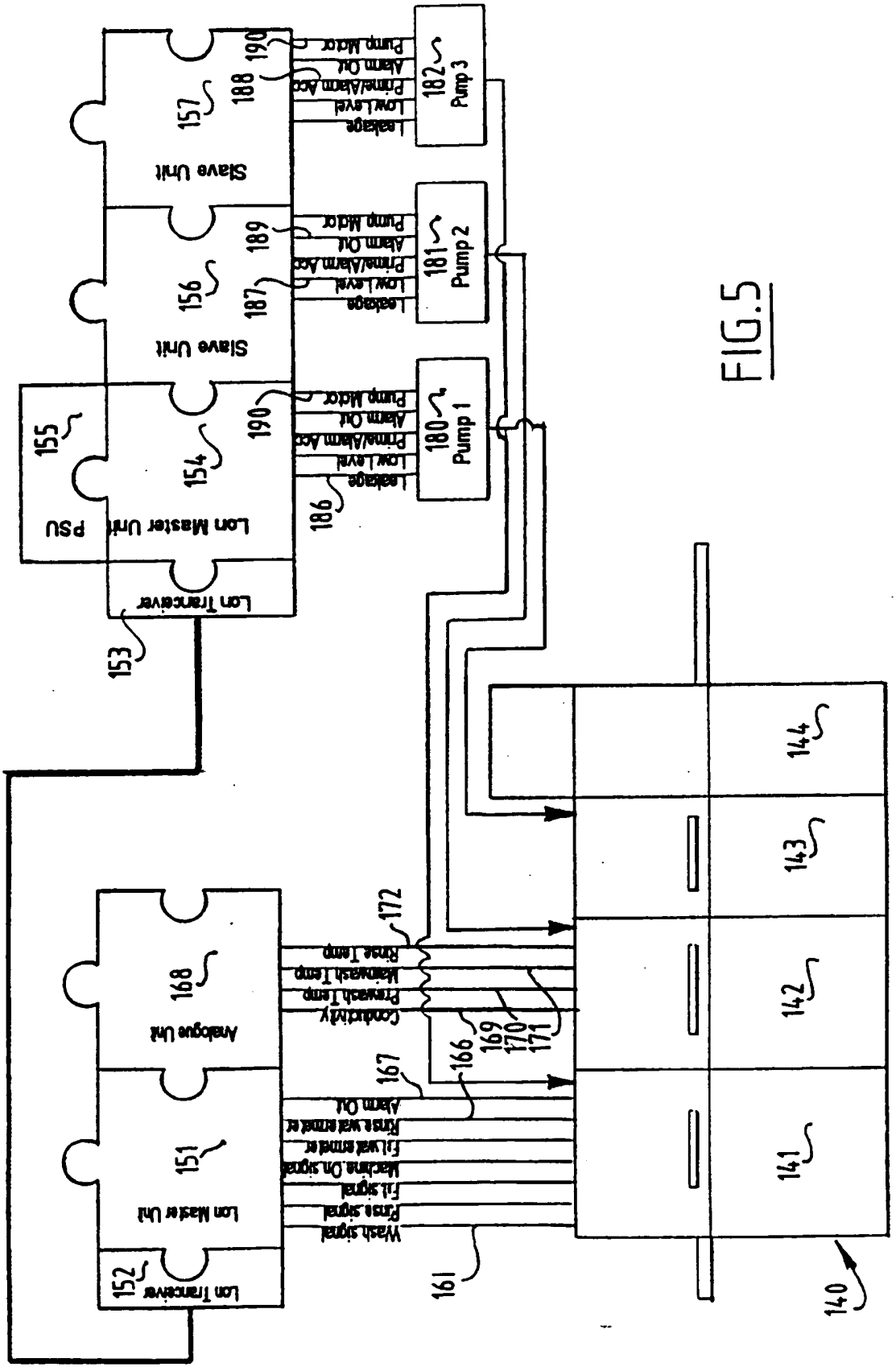
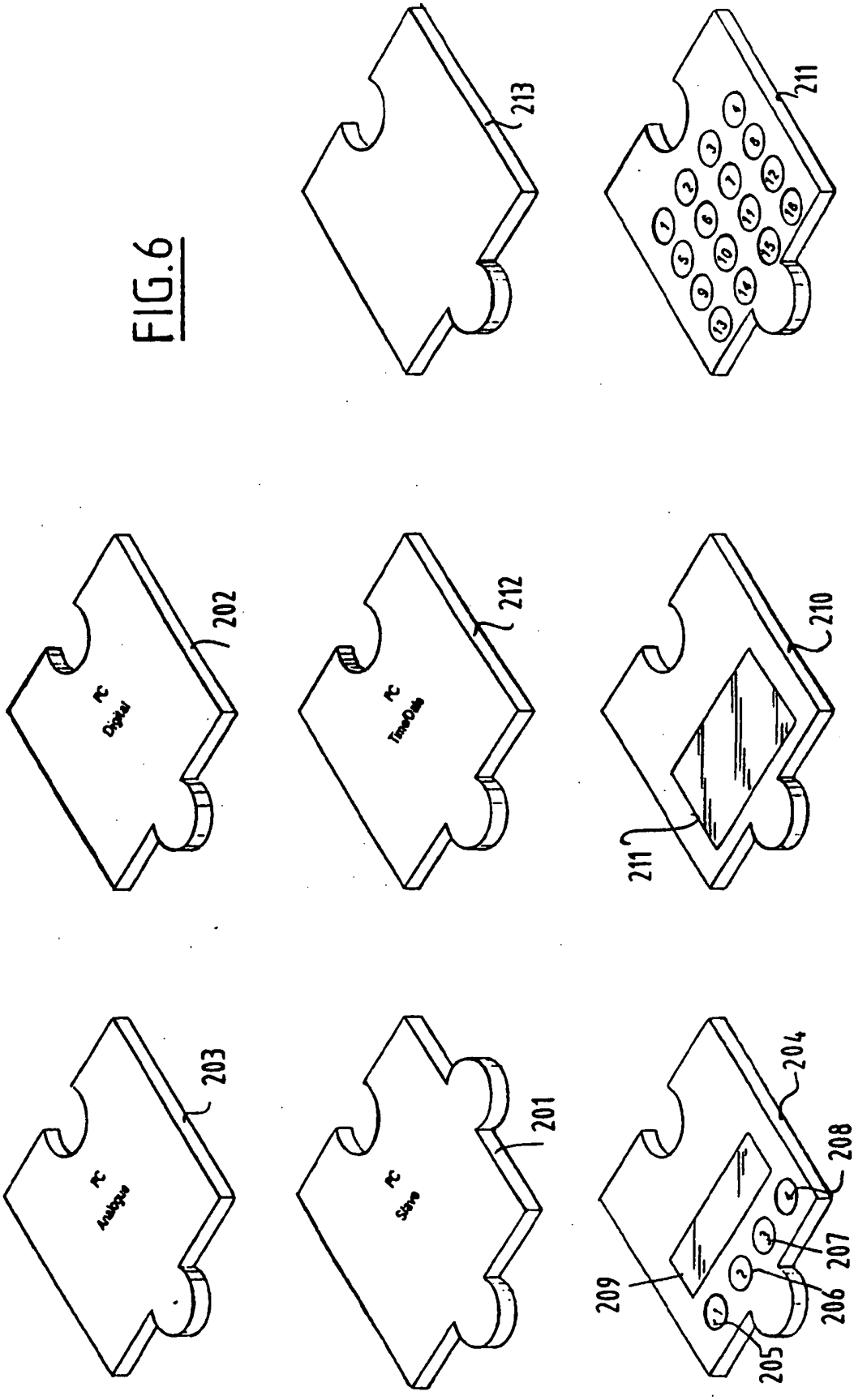

Lon Transceiver
152
Lon Master Unit
151
Analogue Unit
168
Lon Transceiver
153
Lon Master Unit
PSU
155
154
Slave Unit
156
Slave Unit
157
Pump 1
180
Pump 2
181
Pump 3
182
186
187
188
189
190
Leakage
Low Level
Prime/Alarm Ack
Alarm Out
Pump Motor
Wash signal
Rinse signal
Fill signal
Machine On signal
Fill valve error
Rinse valve error
Alarm Out
Conductivity
Rinse Temp
Detergent Temp
Prewash Temp
Maincwash Temp
Rinse Temp
161
166
167
169
170
171
172
140
141
142
143
144

FIG.5

FIG.6



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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0106

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	US-A-5 014 211 (DIVERSEY CORPORATION) * the whole document * ---	1,2,7,8, 11-14,16	D06F39/02 A47L15/44
A	GB-A-2 069 010 (R.D. HAWKINS) * the whole document * ---	1,2,8,9, 11,13,16	
A	US-A-5 392 618 (DIVERSEY CORPORATION) * abstract; figures * ---	1,2,13, 16	
A	WO-A-91 15623 (P.L. CHABARD) * claims; figures * ---	1,2,7,16	
A	US-A-4 932 227 (LEVER BROTHERS COMPANY) * abstract; figures * ---	1,2,13, 16	
A,D	US-A-4 763 494 (LEVER BROTHERS COMPANY) * abstract; figures * ---	1,2,5,15	
A,D	WO-A-92 17952 (ECHELON CORPORATION) ---		TECHNICAL FIELDS SEARCHED (Int.Cl.6) D06F A47L
A,D	US-A-4 918 690 (ECHELON SYSTEMS CORP.) ---		
A,D	WO-A-92 21180 (ECHELON CORPORATION) -----		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 June 1996	Courrier, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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